8. REGULATIONS AND ADVISORIES

The international, national, and state regulations and guidelines regarding americium in air, water, and other media are summarized in Table 8-1.

The Nuclear Regulatory Commission (NRC) maintains a database of information regarding licensees authorized to possess americium isotopes (^{241}Am through ^{244}Am) within the 18 non-Agreement States (states not committed to self-regulation). This database includes more than 2,000 records of licensees and site possession limits in the microcurie to curie range. The isotope ^{241}Am accounts for most of the licenses.

No inhalation or oral MRLs were derived for americium or americium compounds.

The EPA classifies all radionuclides, including americium, as Group A (known human) carcinogens (EPA 1997b). Lifetime excess total cancer risk per unit intake or exposure for ingestion, inhalation, and external exposure to ^{241}Am and ^{243}Am are included in Table 8-1. The EPA has not derived reference concentrations (RfCs) or reference doses (RfDs) for americium (IRIS 2001).

Table 8-1. Regulations and Guidelines Applicable to Americium

Agency	Description	Information	Reference
INTERNATIONAL			
Guidelines:			
IARC		No data	
NATIONAL			
Regulations and Guidelines:			
a. Air			
ACGIH		No data	
EPA	Concentration levels for environmental compliance		EPA 2001a 40CFR61, Appendix E
	^{241}Am	1.9×10^{-15} Ci/m^3	
	^{242}Am	1.5×10^{-11} Ci/m^3	
	^{243}Am	1.8×10^{-15} Ci/m^3	
NIOSH	REL (TWA)	No data	
NRC	Occupational values—inhalation	ALI(µCi) DAC(µCi/mL)	NRC 2001a 10CFR20, Appendix B
	^{241}Am	6×10^{-3} 3×10^{-12}	
	^{242}Am	8×10^{1} 4×10^{-8}	
	^{243}Am	6×10^{-3} 3×10^{-12}	
	Effluent concentrations—air		NRC 2001a 10CFR20, Appendix B
	^{241}Am	2×10^{-14} µCi/mL	
	^{242}Am	1×10^{-10} µCi/mL	
	^{243}Am	2×10^{-14} µCi/mL	
OSHA	PEL (8-hour TWA)	No data	
b. Water			
NRC	Effluent concentrations—water		NRC 2001a 10CFR20, Appendix B
	^{241}Am	2×10^{-8} µCi/mL	
	^{242}Am	5×10^{-5} µCi/mL	
	^{243}Am	2×10^{-8} µCi/mL	
	Releases to sewers—monthly average concentration		NRC 2001a 10CFR20, Appendix B
	^{241}Am	2×10^{-7} µCi/mL	
	^{242}Am	5×10^{-4} µCi/mL	
	^{243}Am	2×10^{-7} µCi/mL	
c. Food			
FDA	Protective action goals and derived intervention levels by age group (Bq/kg)		FDA 1998
	^{241}Am (bone surface)		
	PAGs (mSv)	50	
	3-months	2.0	
	1-year	17	
	5-years	13	
	10-years	11	
	15-years	9.1	
	Adult	8.8	

Table 8-1. Regulations and Guidelines Applicable to Americium *(continued)*

Agency	Description	Information	Reference
NATIONAL *(cont.)*			
FDA	Protective action goals and derived intervention levels by age group (Bq/kg)		FDA 1998
	^{241}Am		
	PAGs (mSv)	5	
	3-months	3.3	
	1-year	27	
	5-years	25	
	10-years	24	
	15-years	21	
	Adult	20	
	Sources of radiation used for inspection of food; sealed units producing radiation—^{241}Am	# 2.2 million electron volts	FDA 2000 21CFR179.21
d. Other			
DOE	Radiation standards—inhaled air DAC for lung retention		DOE 2000 10CFR835, Appendix A
	^{241}Am	$2x10^{-12}$	
	^{242}Am	$3x10^{-8}$	
	^{243}Am	$2x10^{-12}$	
DOT	Activity values for radionuclides		DOT 2001 40CFR173.435
	^{241}Am, ^{242}Am, and ^{243}Am		
	A_1	$5.41x10^{1}$ Ci	
	A_2	$5.41x10^{-3}$ Ci	
EPA	Annual possession quantities for environmental compliance		EPA 2001a 40CFR61, Appendix E
	^{241}Am		
	Gaseous form	$2.3x10^{-6}$ Ci/year	
	Liquid/powder forms	$2.3x10^{-3}$ Ci/year	
	Solid form	$2.3x10^{0}$ Ci/year	
	^{242}Am		
	Gaseous form	$1.8x10^{-2}$ Ci/year	
	Liquid/powder forms	$1.8x10^{1}$ Ci/year	
	Solid form	$1.8x10^{4}$ Ci/year	
	^{243}Am		
	Gaseous form	$2.3x10^{-6}$ Ci/year	
	Liquid/powder forms	$2.3x10^{-3}$ Ci/year	
	Solid form	$2.3x10^{0}$ Ci/year	
	Radioactive waste—release limits for containment requirements[a]		EPA 2001b 40CFR191, Appendix A
	^{241}Am or ^{243}Am	$1x10^{2}$ Ci	
	Reportable quantity		EPA 2001c 40CFR302.4, Appendix B
	^{241}Am	$1x10^{-2}$ Ci	
	^{242}Am	$1x10^{2}$ Ci	
	^{243}Am	$1x10^{-2}$ Ci	

Table 8-1. Regulations and Guidelines Applicable to Americium *(continued)*

Agency	Description	Information	Reference
NATIONAL *(cont.)*			
EPA	Carcinogenicity—slope factors[b]		EPA 1997
	Ingestion—lifetime excess total cancer risk/pCi		
	^{241}Am	3.28×10^{-10}	
	^{243}Am	3.27×10^{-10}	
	Inhalation—lifetime excess total cancer risk/pCi		
	^{241}Am	3.85×10^{-8}	
	^{243}Am	3.82×10^{-8}	
	External exposure—risk/year per pCi/g in soil		
	^{241}Am	4.59×10^{-9}	
	^{243}Am	2.43×10^{-8}	
NRC	Activity values for radionuclides ^{241}Am, ^{242}Am, and ^{243}Am		NRC 2001b 10CFR71, Table A-1
	A_1	5.41×10^{1} Ci	
	A_2	5.41×10^{-3} Ci	
	Specific gravity		
	^{241}Am	3.4 Ci/g	
	^{242}Am	1.0×10^{1} Ci/g	
	^{243}Am	2.0×10^{-1} Ci/g	
	Byproduct material for *in vitro* clinical or laboratory testing—^{241}Am	#0.005 µCi	NRC 2001c 10CFR31.11
	Calibration or reference sources—shall not possess at any one time, at any one location of storage or use of ^{241}Am	#5 µCi	NRC 2001d 10CFR31.8
	Exemption for low-level materials—contains only Americium in special form	aggregate radioactivity # 20 Ci	NRC 2001e 10CFR71.10
	Export of byproduct material	#1 Ci/shipment or #100 Ci/year	NRC 2001f 10CFR110.23
	General applicability to domestic licensing of byproduct material —quantity of licensed material requiring labeling		NRC 2001g 10CFR30, Appendix B
	^{241}Am	1×10^{-2} µCi	

Table 8-1. Regulations and Guidelines Applicable to Americium *(continued)*

Agency	Description	Information	Reference
NATIONAL *(cont.)*			
NRC	Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more sources of byproduct material—exempt quantities of ^{241}Am	0.05 µCi	NRC 2001g 10CFR30.15(a)(9)
	Occupational values—oral ingestion (ALI)		NRC 2001a 10CFR20, Appendix B
	^{241}Am	$8x10^{-1}$ µCi	
	^{242}Am	$4x10^{3}$ µCi	
	^{243}Am	$8x10^{-1}$ µCi	
	Quantity of radioactive material requiring need for an emergency plan for responding to a release—^{241}Am, ^{242}Am, and ^{243}Am		NRC 2001h 10CFR30.72, Schedule C
	Release fraction	0.001%	
	Quantity	2 Ci	
	Standards for protection against radiation—quantity of licensed material requiring labeling		NRC 2001i 10CFR20, Appendix C
	^{241}Am	$1x10^{-3}$ µCi	
	^{242}Am	$1x10^{1}$ µCi	
	^{243}Am	$1x10^{-3}$ µCi	
STATE			
a. Air			
Illinois	Concentrations in air above natural background		BNA 2001
	^{241}Am	S $2x10^{-13}$ µCi/mL	
		I $4x10^{-12}$ µCi/mL	
	^{242m}Am	S $2x10^{-13}$ µCi/mL	
		I $9x10^{-12}$ µCi/mL	
	^{242}Am	S $1x10^{-9}$ µCi/mL	
		I $2x10^{-9}$ µCi/mL	
	^{243}Am	S $2x10^{-13}$ µCi/mL	
		I $4x10^{-12}$ µCi/mL	
	^{244}Am	S $1x10^{-7}$ µCi/mL	
		I $8x10^{-7}$ µCi/mL	

Table 8-1. Regulations and Guidelines Applicable to Americium *(continued)*

Agency	Description	Information	Reference
STATE *(cont.)*			
New Jersey	Maximum permissible average concentrations in air Occupational (40-hour week)		BNA 2001
	^{241}Am	S $6x10^{-12}$ µCi/mL I $1x10^{-10}$ µCi/mL	
	^{242m}Am	S $6x10^{-12}$ µCi/mL I $3x10^{-10}$ µCi/mL	
	^{242}Am	S $4x10^{-8}$ µCi/mL I $5x10^{-8}$ µCi/mL	
	^{243}Am	S $6x10^{-12}$ µCi/mL I $1x10^{-10}$ µCi/mL	
	^{244}Am	S $4x10^{-6}$ µCi/mL I $2x10^{-5}$ µCi/mL	
New Jersey	Maximum permissible average concentrations in air Non-occupational		BNA 2001
	^{241}Am	S $2x10^{-13}$ µCi/mL I $4x10^{-12}$ µCi/mL	
	^{242m}Am	S $2x10^{-13}$ µCi/mL I $9x10^{-12}$ µCi/mL	
	^{242}Am	S $1x10^{-9}$ µCi/mL I $2x10^{-9}$ µCi/mL	
	^{243}Am	S $2x10^{-13}$ µCi/mL I $4x10^{-12}$ µCi/mL	
	^{244}Am	S $1x10^{-7}$ µCi/mL I $8x10^{-7}$ µCi/mL	
b. Water			
Colorado	Standards applicable to surface waters—^{241}Am	0.15 pCi/L	BNA 2001
	Groundwater levels of radioactive materials shall not exceed this amount—Americium	0.15 pCi/L	CO Dept of Public Health and Environ 1999

Table 8-1. Regulations and Guidelines Applicable to Americium *(continued)*

Agency	Description	Information	Reference
STATE *(cont.)*			
New Jersey	Maximum permissible average concentrations in water		BNA 2001
	Occupational (40-hour week)		
	^{241}Am	S $1x10^{-4}$ µCi/mL I $8x10^{-4}$ µCi/mL	
	^{242m}Am	S $1x10^{-4}$ µCi/mL I $3x10^{-3}$ µCi/mL	
	^{242}Am	S $4x10^{-3}$ µCi/mL I $4x10^{-3}$ µCi/mL	
	^{243}Am	S $1x10^{-4}$ µCi/mL I $8x10^{-4}$ µCi/mL	
	^{244}Am	S $1x10^{-1}$ µCi/mL I $1x10^{-1}$ µCi/mL	
	Non-occupational		
	^{241}Am	S $4x10^{-6}$ µCi/mL I $2x10^{-5}$ µCi/mL	
	^{242m}Am	S $4x10^{-6}$ µCi/mL I $9x10^{-5}$ µCi/mL	
	^{242}Am	S $1x10^{-4}$ µCi/mL I $1x10^{-4}$ µCi/mL	
	^{243}Am	S $4x10^{-6}$ µCi/mL I $3x10^{-5}$ µCi/mL	
	^{244}Am	S $5x10^{-3}$ µCi/mL I $5x10^{-3}$ µCi/mL	
c. Food		No data	
d. Other			
Arkansas	Determination of $A_1$and A_2 quantities		BNA 2001
	^{241}Am		
	A1	8 Ci	
	A2	0.008 Ci	
	Specific gravity	3.2 Ci/g	
	^{243}Am		
	A1	8 Ci	
	A2	0.008 Ci	
	Specific gravity	$1.9x10^{-1}$ Ci/g	
	Standards for protection against radiation—^{241}Am	0.01 µCi	BNA 2001
California	Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more source of radioactive material—^{241}Am is considered an exempt quantity	<0.05 µCi	BNA 2001

Table 8-1. Regulations and Guidelines Applicable to Americium *(continued)*

Agency	Description	Information	Reference
STATE *(cont.)*			
Colorado	Determination of A_1 and A_2		BNA 2001
	^{241}Am, ^{242m}Am, and ^{243}Am		
	A1	54.1 Ci	
	A2	5.41×10^{-3} Ci	
Florida	Quantity of radioactive material requiring need for an emergency plan for responding to a release—^{241}Am, ^{242}Am, and ^{243}Am		BNA 2001
	Release fraction	0.001%	
	Quantity	2 Ci	
Georgia	Packages transported between locations within the U.S. which contain only Am or Pu in special form with an aggregate radioactivity	not to exceed 20 Ci	BNA 2001
Kansas	Determination of A_1 and A_2 quantities		BNA 2001
	^{241}Am		
	A1	8 Ci	
	A2	0.008 Ci	
	Specific gravity	3.2 Ci/g	
	^{243}Am		
	A1	8 Ci	
	A2	0.008 Ci	
	Specific gravity	1.9×10^{-1} Ci/g	
Mississippi	Packages transported between locations within the U.S. which contain only Am or Pu in special form with an aggregate radioactivity	not to exceed 20 Ci	BNA 2001
Nevada	Quantities of radioactive material for signs, labels, and signals	0.01 µCi	BNA 2001

[a]Release limit per 1,000 metric tons of heavy metal (MTHM) or other unit of waste.
[b]Radionuclide slope factors are calculated by EPA's Office of Radiation and Indoor Air (ORIA) to assist HEAST users with risk-related evaluations and decision-making at various stages of the remediation process. Ingestion and inhalation slope factors are central estimates in a linear model of the age-averaged, lifetime attributable radiation cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled or ingested, expressed as risk/picocurie (pCi). External exposure slope factors are central estimates of the lifetime attributable radiation cancer incidence risk for each year of exposure to external radiation from photon-emitting radionuclides distributed uniformly in a thick layer of soil, and are expressed as risk/year per pCi/gram of soil.

ACGIH = American Conference of Governmental Industrial Hygienists; ALI = annual limits on intake; BNA = Bureau of National Affairs; CFR = Code of Federal Regulations; DAC = derived air concentration; DOE = Department of Energy; DOT = Department of Transportation; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; I = insoluble; IARC = International Agency for Research on Cancer; mSv = millisievert; NIOSH = National Institute for Occupational Safety and Health; NRC = Nuclear Regulatory Commission; OSHA = Occupational Safety and Health Administration; PAGs = protective action goals; PEL = permissible exposure limit; S = soluble; REL = recommended exposure limit; TWA = time-weighted average